

2.6 Environment And Energy Program Area Description

Mission

The 1995 National Science & Technology Council Report, *Goals for a National Partnership in Aeronautics Research and Technology*, predicted that: "Environmental issues are likely to impose the fundamental limitation on air transportation growth in the 21st century." Thus, the scientific assessment and development of safe and affordable options for mitigating the impacts of aircraft noise and emissions are important not only to protect the environment but also to sustain the growth of aviation. In response, the FAA has adopted the following strategies:

- Lead a cooperative development effort that balances noise reduction with adequate airport capacity.
- Manage FAA activities to understand and minimize adverse environmental consequences and comply with all federal statutes.
- Stimulate private industry and government sponsored research to reduce noise, emissions, and energy consumption by the aviation sector.
- Harmonize international aircraft noise and engine emissions certification standards.

Intended Outcomes

Using its regulatory authority, FAA must serve as an advocate for both the environment and industry. Through an optimal mix of aircraft and engine certification standards, operational procedures, compatible land use, and abatement technology, FAA intends to minimize the global, regional, and local impact of aircraft exhaust emissions.

Program Area Outputs

FAA aviation environmental research produces:

- Noise and emissions standards for the certification of new and modified airframe and engine type designs.
- Technical guidance on certification procedures and practices for manufacturers and modifiers in the form of technical reports, handbooks, advisory circulars, training courses, and rules.

- Computer models and impact criteria for civil aviation authorities to use in the environmental assessment of proposed actions.

Program Area Structure

The aviation environmental research program is a single budget line item, Environment and Energy, and composed of the following major disciplines:

- Aircraft noise reduction and control
- Engine emissions reduction and control
- Aviation environmental analysis

These topics form a cohesive system of research projects that support federal actions to identify, control, and mitigate the environmental consequences of aviation activity.

Customer/Stakeholder Involvement

To mitigate potential adverse impacts to the environment, the FAA works closely with other federal agencies, industry, and foreign governments through a unified regulatory-R&D approach to assess environmental concerns, plan R&D, shape technical requirements, identify feasible abatement technologies or other mitigation actions, and implement aircraft and engine certification regulations. The agency utilizes the following arenas to promote collaboration on aviation environmental issues:

- The Aviation Regulatory Advisory Committee (ARAC) — a formal standing committee composed of representatives from aviation associations and industry. Established by the FAA, ARAC provides industry's recommendations, advice, and information applicable to the full range of FAA rulemaking activities. The harmonization working groups under ARAC have been tasked to ensure that certification regulations impacting both domestic and foreign parties do not impose inconsistent standards in participating countries.
- The International Civil Aviation Organization's (ICAO) Committee on Aviation Environmental Protection (CAEP) — a standing committee that establishes and assesses the adequacy of international aviation environmental standards, especially in the areas of aircraft noise and engine exhaust emissions

standards. The FAA participates, as the United States member along with representatives of other civil aviation authorities and observers from aviation industry.

- The Federal Interagency Committee on Aviation Noise (FICAN) — a permanent body that conducts annual public forums in different geographic regions of the nation to solicit general input on aviation noise. FICAN was established by FAA and other federal agencies with ongoing interests in better aligning R&D with the public's concerns.

Accomplishments

In recent years, the program has produced the following:

- Five reports to Congress on the annual progress of the FAA/NASA subsonic jet noise research program.
- A report to Congress on quiet aircraft technology for light propeller-driven airplanes and helicopters that has led to a joint FAA/NASA research project on general aviation noise.
- Advances in the computer models used for airport and heliport noise analysis. Over 1000 copies have been sold around the world. In the U.S., these models have been used in over 150 airport studies involving more than \$1.3 billion in airport noise compatibility grants.
- Four public forums on aviation noise research in Atlanta, San Diego, Seattle, and Washington. Public participation has resulted in four FICAN annual reports, one report on federal aviation noise research projects, a report to Congress on the effects of aircraft noise, a federal finding on the relationship between aircraft noise and sleep awakenings, and various new federal research projects on commuter airplane noise impacts and the influence of ambient noise on community annoyance.
- Acceptance at the EPA's highest level ("preferred guideline model") of enhancements to the computer model supporting airport air quality analysis.
- Development of a handbook, for use by civil and military aviation authorities, in which

new procedures for airport air quality analysis are defined to improve the quality of federally-reviewed environmental assessments.

- An aircraft overflight noise exposure prediction model for Grand Canyon National Park.
- A new aircraft noise and performance database for use in FAA's Integrated Noise Model (INM).

R&D Partnerships

FAA participates with others in the aviation community in the following joint R&D efforts:

- A series of memorandums of understanding enabling the FAA to work with NASA and U.S. industry to identify source noise and emissions abatement technologies.
- Collaboration with EPA, NASA, industry, and academia to assess the local and global impacts of aircraft engine exhaust emissions.
- Support of the Volpe National Transportation Systems Center's (VNTSC) continuing efforts to provide substantial technical assistance in aircraft noise measurement and assessment.

In addition to the FAA, the U.S. Air Force, the U.S. Army, the U.S. Navy, the Department of Interior, the Department of Transportation, the U.S. Environmental Protection Agency, NASA, and the Department of Housing and Urban Development participate on FICAN, the recognized forum for partnership among all federal agencies concerned with aviation noise. FICAN has led to expanded coordinated and cooperative research efforts among the individual agencies and, thus, results in more efficient use of federal funds. Agencies have signed a letter of understanding formally documenting their participation on the committee and defining its purpose, scope, membership, process, and products.

Long-range View

Planning for environmental research needs beyond 2000 requires a look at key indicators. These are generally described as driving forces for change, targets of opportunities, or future (environmental) threats. Some key indicators that may influence aviation environmental research include:

- Scientific findings

- Air transportation growth
- New aviation technologies
- Increased globalization of aviation
- Reduced federal resources

FAA predicts steady growth of the demand for aviation services into the first decade of the next millennium. The growth in aircraft operations required to meet this demand will result in increased environmental impacts and thus create barriers to further growth.

The key to successful environmental planning is to identify operational mitigation options for those sectors of the growing aviation markets that are most likely to reach environmental critical mass. FAA will need to continue to assess the situation to determine whether research to support mitigation should be directed, for example, towards tour operations over national parks, urban vertiports, resurgent general aviation activity, the old standby large jet transport operations, or a new threat.

Major NASA aeronautics research programs are coming to an end; most notably, the AST program. Several technologies will enter the marketplace within 10-15 years come out of these NASA research programs for use by U.S. industry in the next generations of aircraft. With the end of the AST program, FAA will close its companion research program on subsonic noise reduction. The agency will use its research findings to consider new environmental certification standards and procedures for the next generation of transport aircraft. FAA will shift future environmental research in the field of new aircraft technology toward other research programs and emphasize rotorcraft and general aviation.

The solution to controlling the environmental consequences of new aircraft technologies is through a coordinated regulatory and R&D approach involving the FAA with other federal agencies, such as EPA, NASA and DOD, from the early stages of the technology research.

Technologies, such as the Global Positioning System (GPS), are already beginning to have a profound effect on the aviation system. As these technologies are being introduced to improve system efficiency and flexibility, a new FAA paradigm is emerging under the general term, "Free

Flight." As the FAA builds more user flexibility into the NAS, the agency must expand the current suite of environmental analysis tools in all domains to determine the likely environmental impacts and improvements stemming from its support of Free Flight.

While human (animal) behavioral research is generally not the responsibility of the FAA, the agency must devote research resources to apply pertinent scientific findings on environmental impacts into federal guidance and policy. The findings of earlier FAA and NASA scientific studies also have now been incorporated in the Intergovernmental Panel on Climate Change Special Report on Aviation and the Global Atmosphere, requiring consideration of national and international actions to mitigate global climate change.

As stated in FAA's 1998 Strategic Plan, "The globalization of aerospace, U.S. business, and travel is another factor driving change." What is the potential effect of expanding international and multinational manufacturing centers on the harmonization of international aircraft noise and engine emissions certification procedures and recommended practices? FAA must plan research efforts to support continued international harmonization and standardization of the aviation environmental certification standards and procedures.

The prospect of reduced resources has driven FAA to reorganize and streamline to operate more productively and to identify mission-critical services. Historically, environmental research has accounted for only 2% of the R&D budget. Funding constraints and further reductions are expected to continue to put a premium on identifying the research projects that are critical to FAA's environmental mission. FAA must continually assess the situation in order to effectively target its diminishing resources. Projects that will best address the agency's prime environmental responsibilities through the promulgation of new or improved aviation environmental standards must be given top priority.

To more effectively channel the diminished research resources, FAA embarked on the *Aviation Environmental Research Beyond 2000* project. Through a series of public meetings and workshops, FAA identified environmental issues and needs that could be addressed through research.

2000 FAA NATIONAL AVIATION RESEARCH PLAN

The proposed FY 2001 research program addresses the R&D effort to support an effective environmental mitigation strategy and to identify

the best approaches for addressing current environmental concerns.

A09a — Environment and Energy**GOALS:**

Intended Outcomes: The FAA intends to: reduce the impact of aircraft noise by 80 percent (based upon the 1992 population exposed to DNL 65dB) and prevent any increase thereafter through an optimal mix of new aircraft certification standards, operational procedures, compatible land use, and abatement technology; define and minimize the impact of aircraft emissions, through an optimal mix of new aircraft certification standards, operational procedures, and abatement technology; and mitigate the environmental consequences of aviation operations.

Agency Outputs: The findings of aviation environmental research have resulted in the publication of significant standards, rules and technical guidance including:

- Standards for the certification of new and modified designs for the reduction of aircraft noise and engine exhaust emissions.
- Technical reports, handbooks, Advisory Circulars (AC), training courses, and procedures for use by manufacturers and modifiers.
- Computer models and impact criteria for use by civil aviation authorities in the environmental assessment of proposed actions.

Customer/Stakeholder Involvement: The FAA uses a unified regulatory R&D approach—working closely with other federal agencies, industry, and foreign governments—to guide R&D efforts into the impact of aviation upon the environment. Lessons learned from this research identify and shape technologies, regulations, and certification criteria that offer potential to improve our present and future global environment.

The Aviation Regulatory Advisory Committee (ARAC) is a formal standing committee, composed of representatives from aviation associations and industry. Established by the FAA, ARAC provides industry input in the form of recommendations, advice, and information to be considered in the full range of FAA rulemaking activities. ARAC's harmonization working groups have been tasked to ensure that the aircraft noise certification regulations that impact both

domestic and foreign parties do not impose different standards in each country involved.

The FAA represents the United States on the International Civil Aviation Organization's (ICAO) Committee on Aviation Environmental Protection (CAEP) along with representatives of other civil aviation authorities and observers from the aviation industry. The purpose of CAEP is to establish and assess the adequacy of international aviation environmental standards, especially in the areas of aircraft noise and engine exhaust emissions standards.

The FAA and other interested federal agencies established the Federal Interagency Committee on Aviation Noise (FICAN) to provide forums for debate over needs for future aviation noise research and to encourage new efforts in this area. FICAN conducts annual public forums in different geographic regions to solicit general input on aviation noise impacts with the intent to better align research with the public's concerns.

The Aviation Environmental Research Program directly supports the General Aviation action plan in demonstrating noise abatement technologies for light propeller driven airplanes.

Accomplishments:

- Produced reports to Congress—
 - Report on quiet aircraft technology for light propeller driven airplanes and helicopters. The finding of this report has led to a joint FAA/NASA research project on general aviation noise.
 - Report on the effects of aircraft noise.
 - Five reports on the annual progress of the FAA/NASA subsonic jet noise research program.

Developed advanced computer models—Used for airport and heliport noise analysis. Have resulted in over 1000 copies sold around the world. In the United States, these models have been used in over 160 airport studies involving more than \$1.3 billion in airport noise compatibility grants. This program has also produced an aircraft over-flight noise exposure prediction model for Grand Canyon National Park.

- Public forums on aviation noise research:

- Atlanta
- Minneapolis
- San Diego
- Seattle
- Washington, DC
- Special reports and findings:
 - Four FICAN annual reports.
 - One report on Federal aviation noise research projects.
 - One federal finding on the relationship between aircraft noise and sleep awakenings.

Funding has also led to enhancements to the computer model used for airport air quality analysis and formal acceptance by EPA as a preferred guideline model—EPA’s highest ranking—and to the development of a handbook on the procedures for airport air quality analysis for use by civil and military aviation authorities. Standardizing the civilian and military analytical procedures will improve the quality of environmental assessments that are reviewed by the Federal Government.

R&D Partnerships: The FAA works closely with NASA through a series of memorandums of understanding to identify source abatement technologies. The FAA also participates with NASA, industry, and academia to assess the possible global impact of aircraft engine exhaust emissions. The Volpe National Transportation Systems Center (VNTSC) continues to provide substantial technical assistance in the areas of aircraft noise measurement and assessment. FICAN is also a forum for partnership as all Federal agencies concerned with aviation noise are represented on the Committee. FICAN has led to expanded coordinated and cooperative research efforts among the individual agencies and resulted in more efficient use of federal funds.

MAJOR ACTIVITIES AND ANTICIPATED FY 2000 ACCOMPLISHMENTS:

Aircraft noise reduction and control.

- Submitted final report to Congress on the joint FAA/NASA subsonic jet noise reduction technology program.
- Harmonized FAA helicopter noise certification regulations with those of the European

Joint Aviation Authorities that govern the procedures used by airframe manufacturers.

Engine emissions reduction and control.

- Updated the FAA Engine Exhaust Emissions Databank to be consistent with the ICAO database.
- Continued to examine alternative, simplified engine exhaust emissions measurement procedures to reduce manufacturers certification test costs.

Aviation environmental analysis.

- Released Integrated Noise Model (INM) Version 6 for use in airport noise assessments.
- Completed the first phase of the validation of the Grand Canyon National Park aircraft overflight noise model.
- Continued to examine and validate methodologies used to assess aircraft noise exposure and impact.

KEY FY 2001 PRODUCTS AND MILESTONES:

Aircraft noise reduction and control.

- Perform flight demonstration of propeller driven light airplane noise reduction technology concepts.
- Publish an update of the noise certification handbook (replacement for AC 36-4).

Engine emissions reduction and control.

- Develop a harmonized, simplified engine exhaust emissions certification test procedure that will increase efficiency and reduce costs of the tests.

Aviation environmental analysis.

- Continue to examine and validate methodologies used to assess aircraft noise exposure and impact.
- Release the new emissions and dispersion modeling system.

FY 2001 PROGRAM REQUEST:

Major NASA aeronautics research programs have come to an end. Several new source technologies will emerge from NASA’s research. This will be the basis, in five to seven years, for the next generation of U.S. industry aircraft. The FAA will

close its companion research program on subsonic noise reduction and use its research findings to identify new environmental certification standards and procedures for the next generation of transport aircraft. The FAA will shift future environmental research towards development of new and of improved computer models that will be used to assess aircraft noise, local air quality, and global climate change. In accordance with the National Environmental Policy Act, the FAA must consider and mitigate the environmental consequences of its actions. A variety of methodologies and research are necessary to support and

properly assess the environmental impact of aviation. The objective is to enhance and advance computer modeling techniques to better estimate environmental impacts. The FAA will continue to work with NASA, the manufacturing industry, and foreign authorities to provide technical support for development and implementation of aircraft environmental certification regulations through proactive response to changes in airplane technology, measurement/analysis technology, regulatory policy, and international regulatory initiatives.

2000 FAA NATIONAL AVIATION RESEARCH PLAN

A09a - Environment and Energy Product and Activities	FY 2001 Request (\$000)	Program Schedule					
		FY 2000	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005
091-110 Aircraft Noise Reduction & Control							
Airplane and Rotorcraft Noise Reduction Technologies, Noise Certification Standards & Procedures	\$2,327						
Harmonized FAA Noise Certification Regulations with European Joint Aviation Authorities		◆					
Report to Congress on FAA/NASA Subsonic Jet Noise Reduction Research		◆	◇	◇			
Final Assessment of FAA/NASA Light Propeller-Driven Airplane Noise Reduction Technology Research			◇				
Publish Advisory Circular (AC) 36-4d			◇				◇
Complete Rulemaking to Amend Helicopter Certification Requirements in 14 CFR Part 36						◇	
091-111 Engine Emissions Reduction & Control							
Engine Exhaust Emissions Reduction Technologies, Standards and Procedures, and Impact Assessments	\$2,200						
Updated the FAA Engine Exhaust Emissions Databank to be Consistent with the ICAO Data Base		◆					◇
Develop a Harmonized, Simplified Engine Exhaust Emissions Certification Test Procedure			◇				
Update Advisory Circular (AC) 34-1							◇
Harmonize FAA Engine Exhaust Emissions Certification Regulations with European Joint Aviation Authorities					◇		
091-113 Aviation Environmental Analysis							
Develop Noise and Air Quality Assessment Methodologies	\$1,600						
Released Integrated Noise Model (INM) Version 6 for Use in Airport Noise Assessments		◆					
Completed the First Phase of the Validation of the Grand Canyon National Park Aircraft Overflight Noise Model		◆					
Validate the Methodologies Used to Assess Aircraft Noise Exposure and Impact				◇		◇	
Release INM Version 7							◇
Develop New Helicopter Modeling Methodology and Expanded Helicopter Data Base						◇	
New Emissions and Dispersion Modeling System			◇				◇
Personnel and Other Costs	\$1,316						
Total Budget Authority	\$7,443	\$3,481	\$7,443	\$7,564	\$7,728	\$7,939	\$8,198

Note: Out year numbers are for planning purposes only. Actual funding needs will be determined through the annual budget process.

Budget Authority (\$ in Thousands)	FY 1997 Enacted	FY 1998 Enacted	FY 1999 Enacted	FY 2000 Enacted	FY 2001 Request
Contracts	3,600	2,891	2,239	2,856	6,127
Personnel Costs	0	0	607	589	1,226
Other Costs	0	0	45	36	90
Total	3,600	2,891	2,891	3,481	7,443